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## **A Comparison of the Danish and the Virginia Secondary teacher Education System: Their values and Emphasis on Mathematics Content Knowledge**

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*Abstract: In this paper I will first examine an example of secondary mathematics teacher education in the USA, namely Virginia, then compare it with the secondary teacher education in Denmark. The purpose is both to investigate how much mathematics the students get in the respective systems and secondly to see what this type of teacher education communicates about the values emphasized in the various countries' education systems. I spent more time on explaining the Danish education system than that of the USA and the single states since it is assumed that the reader is familiar with these systems. One cannot necessarily deduce from number of courses how much mathematics the student actually "gets" since this depends on particular passing requirements as well as requirements of entry, the specific content of the courses both in terms of levels of difficulty and topics, etc. However, a comparison of course load indicates how much study of "mathematics" is perceived enough, or minimum, to teach secondary mathematics from the national or state political perspective (who might see a direct link between course load and knowledge).<sup>1</sup>*

### **1. USA**

The USA has on national level no direct legislation in education matters. It is up to each state to determine. However, there are some national legislations such as the No Child Left Behind Act of 2001 (NCLB)<sup>2</sup>. This federal legislation requires states to demonstrate progress from year to year in raising the percentage of students who are proficient in reading and mathematics and in narrowing the achievement gap. NCLB sets five performance goals for states:

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<sup>1</sup> I wish to thank Gwen Lloyd, Associate Professor, Department of Mathematics, Virginia Tech for valuable comments to this paper. The errors remain my own.

<sup>2</sup> <http://www.ed.gov/nclb/landing.jhtml?src=pb>

- All students will reach high standards, at a minimum attaining proficiency or better in reading/language arts and mathematics by 2013-2014.
- All limited English proficient students will become proficient in English and reach high academic standards, at a minimum attaining proficiency or better in reading/language arts and mathematics.
- All students will be taught by highly qualified teachers by 2005-2006.
- All students will learn in schools that are safe and drug free.
- All students will graduate from high school.

This legislation mainly sets goals for the teaching, it does not determine how teaching should take place, methods used, subjects to teach. In terms of teacher education there is on national level the National Council for Accreditation of Teacher Education (NCATE)<sup>3</sup>, which is the professional accrediting organization for schools, colleges, and departments of education in the United States. It is a coalition of over 30 organizations representing teachers, teacher educators, policymakers, and the public. There is also the national Praxis I and II tests. The Praxis Series tests are currently required for teacher licensure in 39 states and U.S. jurisdictions. These tests are also used by several professional licensing agencies and by several hundred colleges and universities. Because The Praxis Series tests are used to license teachers in many states, teacher candidates can test in one state and submit their scores for licensure in any other Praxis user state.<sup>4</sup> Therefore to compare “USA’s” teacher education system one must focus on the level of the states. In this paper I have decided to study Virginia.

## 1.1 Virginia

The Virginia Licensure requirements<sup>5</sup> for teaching mathematics grades 6-12 are that the student has completed a major in mathematics or 36 semester/credit hours of course work distributed in each of the following areas: Algebra (including linear and abstract algebra), Geometry (including Euclidean and non-Euclidean geometries), Analytic geometry, Probability and statistics, Discrete mathematics (including the study of mathematical properties of finite sets and systems and linear programming), Computer science (including computer programming), and Calculus (including multi-variable calculus). This should also include knowledge in the history of mathematics. Students should obtain passing scores of 147 on the Praxis II (mathematics content) test.

## 2. Denmark

The Danish school system is different from the US system. Formal schooling begins at the age of seven. Then follows 9 years of compulsory comprehensive

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<sup>3</sup> <http://www.ncate.org>

<sup>4</sup> <http://www.ets.org/praxis/prxtest.html>

<sup>5</sup> [http://www.math.vt.edu/people/lloyd/math\\_licensure/VA\\_licensure.pdf](http://www.math.vt.edu/people/lloyd/math_licensure/VA_licensure.pdf)

schooling. This is called the *Folkeskole* (People school). In the first grade the student is placed in a class according to age only. The students stay together through all 9 years. There is an optional one-year pre-school class from the age of six commonly called Grade 0. The class has its own room - the so-called "Classroom" and the class also has a "Class-teacher". The teachers have one big common room. Teacher preparation usually takes place at the teachers' private home. Hence the teachers are not at the school the whole day but often only around the times where they teach or if there is a meeting. There is an option of a grade 10 in the *Folkeskole*. This is usually chosen by students who are not sure what education they want.

The teaching during the first nine years covers the following subjects: Danish (all grades), English (3-9), Christian studies<sup>6</sup> (all levels except the level where the confirmation preparation of the Evangelical Lutheran Danish National Church takes place), History (3-9), Social studies (8-9), PE and sports (all levels), Music (1-6), Art (1-5), Textile design, wood/metalwork and home economics (one or more levels within grades 4-7), Mathematics (all levels), Science/technology (1-6), Geography (7-8), Biology (7-9), Physics/chemistry (7-9), German (or sometimes French, non-compulsory, 7-9). Bilingual children (0-10) are being given instruction in Danish as a second language. The Minister of Education lays down provisions pertaining to the instruction in Danish as a second language for bilingual children and to mother-tongue teaching of children from the European Union, the European Economic Area, the Faroe Islands, and Greenland. There is also a number of optional topics in grades 8-10.

The Danish Parliament makes the decisions governing the overall aims of the education, and the Minister of Education sets the targets for each subject. But the municipalities and schools decide how to reach these targets. The Ministry of Education publishes curriculum guidelines for the subjects, but these are seen as recommendations and are not mandatory for the municipalities. Schools are permitted to draw up their own curricula in accordance with the aims laid down by the Minister of Education. However, nearly all schools choose to confirm the centrally prepared guidelines as their binding curricula.<sup>7</sup> The *Folkeskole* is not an examination-oriented school and school failure is almost non-existing. The *Folkeskole* builds on the principle of differentiated teaching to sustain the

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<sup>6</sup> The Act (1 August 1994) states: "6. (1) The central knowledge area of the subject of Christian studies shall be the Evangelical Lutheran Christianity of the Danish National Church. At the oldest form levels, the instruction shall furthermore comprise foreign religions and other philosophies of life. (2) If requested, a child shall be exempted from participation in the instruction in the subject of Christian studies, when the person who has custody of the child submits a written declaration to the headteacher of the school to the effect that he/she will personally assume the responsibility of the child's religious instruction. ... If the child has reached the age of 15, exemption can only be granted with the child's own consent." 53(1) Upon negotiation between the municipal council and the ministers in the municipality, time shall be set aside for the preparation for confirmation. If agreement cannot be reached between the parties, the decision shall be taken by the municipal council upon consultation of the parish councils involved.

<sup>7</sup> <http://www.uvm.dk>

principle that all students should be given adequate challenges. At grades 8-10 the teaching may be organised in teams within the individual class and across classes and grades.

In grades 1-7, assessment is given either in writing or verbally in the form of meetings where student, parents, and Class-teacher take part. In grades 8-10 a grading system (13-point marking scale) is added and the student receives a written report at least twice a year for the leaving examination subjects. Examinations are offered at grades 9 and 10. There are national standard rules for all examinations. The papers for the written examinations are set and marked centrally. The other examination questions shall be drawn up by the teacher or by an external examiner according to a decision taken by the Minister. Examinations are not compulsory and each examination subject is assessed on its own merit; results cannot be summed up to give an average mark. The school shall issue a leaving certificate for students who leave school at the end of grade 7 or later.

88% attend municipality schools and 12% that attend various forms of private or “free schools” that are subject to various rules. The idea with the free-schools is that a number of parents or firms can get together and run a school with help from state funding (Selander, 2000, p. 65). The private schools receive a grant (“per student per year”) for their operational expenditures which in principle matches the public expenditures in the municipal schools - less the private school fees paid by the parents. This is to ensure that public expenditures for the private and municipal schools follow the same trend.

After the *Folkeskole* young people have five options: (1) The *Almene Gymnasium* (General Academic High Schools) is a three-year upper secondary education. (2) The *Højere Forberedelseseksamen (HF)* (Higher Preparatory Examination Course) is a two-year course that is meant for adults and for students who have completed the 10<sup>th</sup> grade of the *Folkeskole*. These two are preparatory for higher education. (3) The three-year Commercial High School (*Handelsskole/Handelsgymnasium*). (4) The three-year Technical High School (*Teknisk skole/Teknisk Gymnasium*). Both of these give access to higher education as well as prepare for professional activities in the private sector. (5) Vocational education and training courses (*Erhvervsuddannelserne*) with theoretical training (1/3) at technical schools and practical training as an apprentice (*lærling*) (2/3) at an enterprise. Teacher education for these 5 places is different. (1) and (2) are the same, and I will describe this more detailed below. Teacher education for the *Folkeskole* is also different. While the *Folkeskole* is administered on the level of municipality, the *Almene Gymnasium* and *HF* are administered at the level of county.

The subjects offered in the *Almene Gymnasium* and *HF* are the following: 1. Astronomy, Visual arts, Biology, Danish, Computer science, Design, Drama, Information technology, English, Business economics, Film and TV studies, Philosophy, French, Physics, Geography, Greek, History with civics, Physical

education and sport, Italian, Japanese, Chemistry, Latin, Mathematics, Music, Science, Classical studies, Psychology, Religious studies, Russian, Social studies, Spanish, Technology, German. The students cannot choose freely, but there are some bindings, which I will not go into detail with here as this is not the scope of the paper.

## 2.1 Teacher education for the *Folkeskole* (grades 1-9 (10))

There is a four-year unified training system for the whole compulsory nine-year schooling (including the optional grade 10). It takes place at one of the country's 18 *Seminarier* (College of Education). One study-year amounts to a full-time job. The school-year begins in the beginning of August and ends at the end of June. A study-year consists of teaching, lecturing, supervision, student teaching, independent work, and various study form such as group work, project work etc. Through the four years the student takes courses within the areas listed below. The number in brackets shows how much it weighs in relation to a one-year-study full time. The student is obliged to study four *Liniefag* "Line-subjects" which would be the subjects that the student will then mainly be teaching in the *Folkeskole*:

- Christian studies (0.2)
- The *Liniefag* Danish or Mathematics (0.7)
- 3 other *Liniefag* (3 x 0.55)
- Pedagogical subjects:
  - The school in the society (0.1)
  - Pedagogy (0.2)
  - Psychology (0.2)
  - General didactics (0.2)
- Teaching practices (0.6) (24 weeks at a school).

If a student chooses mathematics as the 0.7 *Liniefag*, this amounts to 1150 workings hours. At for instance Aalborg Seminarium, this in practice means 338 lesson-hours over a three year period. The rest of the time is spent on independent study and preparation for the exam.<sup>8</sup> The four *Liniefag* are being chosen among the 18 subjects that exist in the *Folkeskole*. One of the *Liniefag* must be either Danish or Mathematics, but the students can choose both subjects. The four *Liniefag* shall represent at least two of the following areas: The humanistic area, the natural science area, and the practical-musical area.

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## 2.2 Teacher education for the *Almene Gymnasium* (grades 10-12)

One can usually not teach just mathematics in the *Almene Gymnasium*, one need to have *Pædagogikum* (pedagogical competence) and *Fagkompetence* (subject competence) in two topics. The formal route is first to study mathematics as well as another subject at a university. Most mathematics teachers in the *Almene Gymnasium* have either physics or chemistry as their second subject, but any combination is possible. One needs to study these two subjects to the level of a *Candidata/Candidatum* (female/male) degree. This degree can be translated into a US Master's degree. It consists of a *Hovedfag*, which directly translated means 'major subject', but not to be confused with what is called 'a major' when studying at a US university. In Denmark it is 3.5 years of full time study. The other part of the degree is a *Sidefag/Bifag*, which directly translated means 'minor subject', but not to be confused with what is called 'a minor' when studying at a US university. In Denmark it is 1.5 years of full time study, for instance the 3<sup>rd</sup> - 5<sup>th</sup> semester of the *Hovedfag* study. When the candidate studies mathematics, all courses from the first semester are mathematics courses. There are not any "general education courses" to give them an all-round knowledge. General education takes place at the *Almene Gymnasium*. At university one gets "specialized".

After the end of the 5-year *Candidata/Candidatum* degree, the teacher candidate can apply for 2-year "Education positions" advertised at the *Alment Gymnasium*. Sometimes these are also advertised by the County Council. If accepted the student enters into a two-year program which includes a 6-month (one semester) *sidefagssupplerling* (Minor Subject Supplementary) of 700 working hours to give teachers extra subject area knowledge. The two-year education is then divided into Subject Competence and Pedagogical Competence. The pedagogical competence is divided into a Practical *Pædagogikum* and a Theoretical *Pædagogikum*. It is the principal who has the overall responsibility and who appoints a main course responsible (usually one of the teachers at the school). The course responsible plans and coordinates the candidate's education. The course responsible supervises the candidate during the Practical *Pædagogikum* and determines in collaboration with a person appointed by the Ministry of Education if the candidate has passed.

### 2.2.1 Subject Competence

The students who aspire to become teachers study mathematics alongside any other mathematics student. Some universities have previously had education classes, but these things changed alongside the recent reforms (2004) of the licensure. The principal assigns *Faglig Kompetence* on the basis of the candidate showing mastery of the central area of the subjects and its terminology and methods, have knowledge of use of ICT, is able to gain new knowledge when the subjects develops, and has sufficient knowledge of the Danish language.

### 2.2.2 Practical *Pædagogikum*

During the first year of Practical *Pædagogikum*, the candidate teaches a "practice class" under supervision by the subjects' teachers. The planning of the teaching takes place in collaboration with the teachers. Parallel to this is a discussion of the students' preconditions, lesson planning, questioning techniques, working methods as well as assessment and evaluation. The total number of teaching and observation lessons are 180 hours corresponding to 480 working hours which includes preparation and work after class. The candidate must also participate in general pedagogical tasks at the school. During the second year the candidate teaches more independently in his or her own classes while periodically receiving supervision. At the same time the candidate must write a final project.

### 2.2.3 Theoretical *Pædagogikum*

Theoretical *Pædagogikum* consists of general pedagogy and subject pedagogy. The amount of teaching and preparation for candidates with two subjects is around 530 hours. The teaching is partly distance education and weekend courses. Subject pedagogy consists of three parts: one course in subject didactics in each of the candidate's subjects (around 60 hours per subject), course in subject didactics in subjects related to the candidate's subjects (around 60 hours), and a course in use of ICT in the subjects (around 50 hours). General pedagogy consists of three parts: One course in general pedagogy (around 170 hours) which consists of lesson planning, communication, evaluation, different teaching strategies, teacher collaboration, learning processes, theories of learning, teacher roles. Another course is in organisation culture and school development (around 30 hours) and the third course is in general *Gymnasium* relevant topics (around 30 hours) such as knowledge of the school's computer system, use of ICT as communication between teachers and teachers and students, and its use in the school administration. There is also a Common Course in Subject pedagogy and General pedagogy (around 50 hours). The goal is to make the candidate able to reflect about the subjects and the relation between them in terms of the *Almene Gymnasium* in general, as well as in relation to value and ideas of education and the development of a general and broad competency for the students.

## 2.3 Values and the principle of general education

### 2.3.1 Denmark

As stated in Dahl and Stedøy (2004), Denmark has, in line with the rest of the Nordic countries (Iceland, Finland, Norway, and Sweden) the same educational objectives which are equal access to (lifelong) learning, teaching democracy, independence, equality, and the development of critical awareness in students. The focus is broad and comprehensive as opposed to elitist (Andersen, 1999, p. 27). A central goal in Swedish education policy is that students must learn more



than mere knowledge and therefore the teaching of respect for human values is equally important (Swedish Ministry of Education, 2000b). It is necessary to develop a “democratic mentality” in the students (Swedish Ministry of Education, 2000a, pp. 6-9). The purpose of the pre-school as well as the whole compulsory education is to develop the child’s ability to function and act socially responsibly, to make sure that solidarity and tolerance are learnt at an early stage, and to counteract traditional sex roles (Swedish Ministry of Education, 2000a, pp. 113-114). One can see a similar focus in Norway in the curriculum of 1997 for grades 1-10. Here it is written in the preface that the general education shall built on basic Christian and humanistic values. It shall promote equality between the sexes and solidarity among different groups in the society (Norwegian Ministry of Education, 1997, pp. 17-18). Also the Danish law for the *Folkeskole* from 1975 reflects this, as it is written that a task for this school is to prepare the students to participation and decision-making in a democratic society and to share the responsibility for solving common tasks (Selander, 2000, p. 70). Therefore the school’s education and daily life must build on freedom of spirit and democracy. The present Act of the Danish *Folkeskole* states the following:<sup>9</sup>

- (1) The *Folkeskole* shall – in cooperation with the parents – further the students’ acquisition of knowledge, skills, working methods and ways of expressing themselves and thus contribute to the all-round personal development of the individual student.
- (2) The *Folkeskole* shall endeavor to create such opportunities for experience, industry and absorption that the students develop awareness, imagination and an urge to learn, so that they acquire confidence in their own possibilities and a background for forming independent judgments and for taking personal action.
- (3) The *Folkeskole* shall familiarize the students with Danish culture and contribute to their understanding of other cultures and of man’s interaction with nature. The school shall prepare the students for active participation, joint responsibility, rights and duties in a society based on freedom and democracy. The teaching of the school and its daily life must therefore build on intellectual freedom, equality and democracy.

The Swedish Education Act states that all children and youths shall have equal access to education, regardless of gender or social or economic factors. This right of education also extends to adults. The education shall “provide the students with knowledge and, in co-operation with the homes, promote their harmonious development into responsible human beings and members of the community” (Skolverket, 2003).

The Nordic countries have therefore the same educational objectives in common, which are equal access to (lifelong) learning, teaching democracy, independence, equality, and the development of critical awareness in students. The focus is broad and comprehensive as opposed to elitism (Andersen, 1999, p. 27). The ‘Nordic dimension in education’ as discussed by Dahl (2003), is therefore that the teaching of democratic values is as important as the teaching of knowledge. The focus is on a “school for all”, adult (lifelong) education, equality, democracy, and a high number of people receiving further education. The systems are decentralised school system with possibilities for choice. The whole school structure is organised in a single track.

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<sup>9</sup> <http://www.uvm.dk>

### 2.3.2 Virginia

Virginia implemented state-mandated Standards of Learning (SOL) and associated tests (Virginia, 1995). The purpose of the SOL's is:

The intent of the Virginia Board of Education and the Superintendent of Public Instruction to establish high academic standards for our young people and greater accountability for our public schools throughout the Commonwealth. The Board and the Superintendent concur that Virginia's academic standards need to be measurable in order that parents and taxpayers may see how their students and schools are performing against these high academic standards. While not compromising the rigor which will demand higher performance, we also believe that Virginia's standards must address the educational expectations for ALL Virginia students.

...

The Board and Superintendent believe that high academic standards are the beginning of a multi-year journey to improve educational achievement. For these new standards to make a real difference, we will need to develop accountability measures and consequences for students and teachers, invest in new teaching materials, provide extensive professional development, expand the use of technology, involve parents in the education of their children at the school level, and expect our students to work harder, including doing more work at home.

More specifically the Board and the Superintendent have identified various areas that are critical to the discussion relating to academic standards and accountability. These areas are centered on that accountability as best being addressed at the school building level. The local school boards must hold individual teachers accountable for their performance and the achievement of their students. The preferred method of school improvement is to reward schools for achieving the targeted improvement in student performance. It is furthermore the state's responsibility is to set expectations for what students should know at key points but it is the responsibility of the local school boards and schools is to determine how the students reach these expectations. There also need to be consequences for students. Hence, in the Virginia Board of Directors resolution from 1995, there is no reference to "democratic education" or development of critical awarenesses of the students. In terms of the topic mathematics, The Board, stated that "Students today require stronger mathematical knowledge and skills to pursue higher education, to compete in a technologically oriented workforce, and to be informed citizens. Students must gain an understanding of fundamental ideas in arithmetic, measurement, geometry, probability, data analysis and statistics, and algebra and functions, and develop proficiency in mathematical skills." What comes closest to the "Nordic model" here is the remark about being "informed citizens". But being an "informed citizens" is not the same as preparing a student for active participation in the democracy nor something that contribute to an all-round personal development.

However, when one looks at the SOL<sup>10</sup> of history and the social sciences, one does see more of the things mentioned in the Nordic countries. For instance the overgoal is stated as follows:

The study of history and the social sciences is vital in a democratic society. All students need to know and understand our national heritage in order to become informed participants in shaping our nation's future. The History and Social Science Standards of Learning were developed with the assistance of educators, parents, business leaders, and others with an interest in public education.

The History and Social Science Standards of Learning are designed to

- develop the knowledge and skills of history, geography, civics, and economics that enable students to place the people, ideas, and events that have shaped our state and our nation in perspective;
- enable students to understand the basic values, principles, and operation of American constitutional democracy;
- prepare students for informed and responsible citizenship;
- develop students' skills in debate, discussion, and writing; and
- provide students with a framework for continuing education in history and the social sciences.

Particularly point 2 and 3 shows that it seems, that the Virginia SOL does emphasise teaching of democratic values. However, the main difference between Denmark and Virginia still seems to be if this is part of the overall goal of the education system, or something that is “reserved” for particular topics. This is not to downplay the quality of the teaching in history and social science, but of the whole Virginia system seems different than that of the Nordic countries where the education in democracy is clearly stated as part of the overall goal, alongside the teaching of knowledge whereas the overall goal of the Virginia Board of Educators seems to be on accountability and tests. And as stated above, formal examinations do not exist in the Danish school system until grade 8.

### 3. Discussion

How many mathematics hours?

What does “full time” means? One year of “full time study” in Denmark is equivalent to 60 ECTS (European Credit and Transfer System) of study. This is independent on whether the student is a graduate or undergraduate. In fact there is not this distinction in the Danish system. One is instead an x-semester student, a *Hovedfags*-student, *Sidefags*-student, or when one writes one's Master's thesis (*Speciale* = “Specialization thesis”) within one's *Hovedfag*, one is a *Hovedfags*-student. Depending on where one looks for a “translation” from the European system into the system in the USA, 1 ECTS credits represent the value of 1/2 US credit<sup>11</sup> or 1 ECTS credit could be considered equivalent to 2/3 US semester

<sup>10</sup> [http://www.knowledge.state.va.us/main/sol/solview.cfm?curriculum\\_abb=HSS](http://www.knowledge.state.va.us/main/sol/solview.cfm?curriculum_abb=HSS)

<sup>11</sup> <http://www.goglobal.ch/incoming/pages/ects.html>

credit hours.<sup>12</sup> “Full time” in Denmark is also defined as the student on average spending 37 hours per week “studying” i.e. attending lectures, preparing for classes etc. At Aalborg University, Department of Mathematics, 1 ECTS is defined as 5 “4-hour lessons”.<sup>13</sup> “Full-time” is also what as good as all students would do, since this is the only way to receive the State Education Grant.<sup>14</sup> These grants are giving freely to all students on state approved programs and most often these programs are “packages” i.e. that if one decides to study mathematics, then each semester has a number of predetermined courses – so a course in one sense is a x-semester course. At some point during the study, one can choose between a number of “directions” that each has its own “package” of courses that one follows.

In Virginia, at for instance Virginia Tech<sup>15</sup>, a full-time undergraduate student takes 12 or more credit hours, a graduate student 9 credit hours or more. During the summer terms the same numbers are 5 credit hours for the undergraduates and 3 credit hours for the graduates. However, during Fall and Spring semester, an undergraduate student can take up to 19 credit hours<sup>16</sup>, a graduates 18 credit hours<sup>17</sup>, before it is considered “overload” and the student needs special permission.

For the academic year 2004-2005, at Virginia Tech, the fall semester began 23 August and ended 16 December, while the spring semester began 17 January and ends 11 May. The two summer terms are 23 May – 2 July and 5 July – 13 August. In Denmark, the fall semester begins the first week of September and ends the last week of January, Spring semester begins the first week of February and ends the last week of June. January and June are usually examination months. Holidays are at Christmas, Easter, Pentecost, and Assension Day as well as July and September. This means that the Virginia Fall semester + Spring semester + “half” the summer term and the Danish Fall semester + Spring semester are approximately of equal length.

What is clear from this “comparision” is that nothing is “clear” and that a “fair comparison” of what is “full time” becomes very difficult. For the sake of convenience and as a “compromise” between the different interpretations, I will use 15 USA credit hours as being equivalent to the European 30 ECTS. When a future Virginia secondary mathematics teacher have studied mathematics 36 credit, or semester, hours, most would have done this as part of their undergraduate degree. This means that the minimum state requirement for a secondary mathematics teacher in Virginia amounts to  $36/30 = 1.2$  years “full time” study of mathematics.

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<sup>12</sup> <http://www.ncsu.edu/studyabroad/staff/equiv/ects.pdf>

<sup>13</sup> <http://www.math.aau.dk/index.html>

<sup>14</sup> <http://www.su.dk/>

<sup>15</sup> <http://www.registrar.vt.edu/registration/enrollstatus.html>

<sup>16</sup> <http://www.clahs.vt.edu/UAAO/pol-procedure%20page.htm>

<sup>17</sup> <http://www.registrar.vt.edu/registration/minmaxenroll.html>

The Danish *Alment Gymnasium* mathematics teacher has studied mathematics full time at least 2 years (if they have mathematics as *Sidefag* and then have taken the half-year *Sidefagssupplering*), and many would have studies mathematics full time for 3.5 years (if they have mathematics as *Hovedfag*). The Danish *Folkeskole* teacher has studies mathematics either 0.55 or 0.70 years.

Country/State	Denmark		Virginia
Grade-level	1-9 (10)	10-12	6-12
Years of mathematics	0.55 – 0.70	2 – 3.5	1.2 (1.8)

This means that the Danish *Gymnasium* teacher has taken between 1.7 and 2.9 times more mathematics courses than the general Virginia teacher. However, the Virginia teacher (grades 6-9) has between 1.4 and 1.8 times more mathematics courses than the Danish *Folkeskole* teacher. Furthermore, in terms of years of study, in Denmark, the *Almene Gymnasium* teacher with teacher qualification has done around 7 years of study, while a *Folkeskole* teacher has done 4 years of study. Secondary mathematics teacher in Virginia have, if they have a Master's degree, have done 5 years of study.

This is when one looks at the state requirements in both Virginia and Denmark. In practice in Virginia, the universities require more of their students. For instance at Virginia Tech, students in the 5-year program for secondary mathematics teachers must take 30 credit hours of mathematics as undergraduates, two mathematics electives, 3 credit hours in computer science, 3 in probability and statistics, and 10 credit hours of mathematics courses designed for teachers. This adds up to 46 hours of mathematics and mathematics-related coursework as undergraduates. As graduates, they must take 2 graduate mathematics electives and one more mathematics course designed for teachers. This adds up to 9 credit hours. Altogether a student with a graduate degree from the Virginia Tech Secondary Mathematics Education Teacher Licensure Program, Master of Arts in Education, would have taken around 55 credit hours of mathematics.<sup>18</sup> This means that at Virginia Tech, the students take courses amounting to  $55/30 = 1.8$  years of full time study, hence the 1.8 in the table above. The reason for this is that the state requires “minimum” while the universities often require a higher standard.

Regardless of this, it seems in general that the Danish *Almene Gymnasium* teacher is better prepared in terms of mathematics content knowledge (if one can deduce directly from number of course taken to amount of knowledge) than the Virginia secondary teacher, while the Virginia teacher is better prepared than the Danish *Folkeskole* teacher.

<sup>18</sup> The 55 credits hours comes if one includes the computer science classes as well as the mathematics courses designed for teachers where in some of the courses the mathematics “level” is grade 6-12 but the students “relearn” it while at the same time learn how to teach this level of mathematics.

What about the content knowledge and the more “soft values”?

It seems that Denmark values education in democracy as much as the teaching of knowledge whereas teaching a democratic awareness does not seem to be emphasised a lot in the Virginia system - where instead content knowledge and tests are emphasised. It might therefore seem peculiar that student teachers in the US system have less mathematics than in Denmark. Another peculiarity is that the Danish systems emphasises the teaching of general values. This can both be seen in the teacher education for the *Folkeskole* - for instance in the mandatory Christian subject, as well as some of the courses in the theoretical *pædagogikum*.

This is not to say that one system is “bad” the other one is “good”. But in seeing the differences - and perhaps the internal inconsistencies in them – one might learn more about one’s “own” system, how it can be improved, by seeing how other’s have chosen to do it. Perhaps the Danish *Folkeskole* teacher education system needs to require more mathematical content knowledge, perhaps the Virginia state requirements needs to be higher in terms of content knowledge, perhaps the Danish *Folkeskole* teachers need more than 0.2 years of Christian studies, since “soft values” obviously are important, perhaps the Virginia school system need more emphasis on bringing up good citizens, etc. etc. The reader can make up his or her own mind.

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